RESEARCH PRIORITIES FOR FURBEARERS IN BRITISH COLUMBIA

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EXECUTIVE SUMMARY

1. The major objective of this study was to identify and priorize furbearer management problems and research needs in British Columbia.

2. The major information source was a questionnaire sent to 43 trappers and furbearer resource managers. Thirty-six questionnaires (84%) were returned. Other sources of information included provincial catch statistics, pelt values, and scientific literature.

3. The four highest priority management problems for furbearers in general were all habitat issues related to the forest industry. This included lack of integration of furbearer and forest management, effects of forest harvesting, effects of herbicides, and effects of other silvicultural practices. Priorities 5 to 8 were primarily population related. Effects of land users other than the forest industry, and damage problems caused by furbearers, were generally low priority issues for the British Columbia furbearer resource.

4. The highest five-species priorities for research attention were suggested to be as follows (most important to least important): marten, lynx, wolverine, fisher, beaver.

5. The 25 highest priority research topic-furbearer species combinations provided a basis for recommendation of research programs. Only 5 of 16 possible species occurred on this list (marten, lynx, beaver, mink, muskrat). Despite generally high priority given to wolverine and fisher as research targets, specific research topics for them did not score in the top 25.

   Consistent with points 3 and 4 above is the fact that the four highest priority research topic-species combinations all involve marten and all involve habitat-related research primarily concerned with forest management. This includes research on habitat selection/requirements, effects of logging, effects of herbicides, and effects of other silvicultural practices. Four different population research topics for marten occur in the top 25 species-research topic combinations. Two appear to be of higher priority than the others: determination of population densities in representative habitats, and assessment of relationships between harvest pressure and age/sex composition of the catch.

   The four highest priority research topics for lynx are the same as for marten, i.e. predominantly forestry-related habitat research. Only one population-related topic for lynx appeared in the top 25 - determination of population levels in representative habitats.

The five beaver research topics in the top 25 are all habitat-related. Of greatest concern seems to be research on the potential impact of forest herbicides on riparian vegetation used by beaver. The closely related topics of research on wetland management and on habitat improvement appear to rate higher priority than forest industry impacts, with the exception of herbicides.

The highest priority research item for mink, effects of herbicides on habitat, tends to emphasize the broad importance of this topic. The only muskrat research topic in the 25 involves studies of wetland management.

6. The 25 highest priority species-research topic combinations are grouped into four potential research programs, as follows:

   Priority 1. Studies of habitat selection and use by marten and lynx in logged and unlogged areas (possible secondary attention to wolverine and fisher).

   Priority 2. Research on population parameters of trapped and untrapped marten and lynx populations (possible secondary attention to wolverine and fisher).

   Priority 3. Evaluation of the impact of forest practices, especially herbicides, on beaver and mink and their habitat.

   Priority 4. Wetland management/habitat improvement research for beaver and muskrat.

Study objectives and design, and previous relevant research on these topics, are briefly discussed.

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1.0 INTRODUCTION

In the winter of 1986/87, approximately 6000 trappers in British Columbia harvested wild fur pelts with a total value approaching 6 million dollars. This economic activity provides important supplementary income for many residents, and is the main source of income of some northerners. Steadily increasing harvest pressure stimulated by recent increases in pelt value, together with continuing impacts on furbearer habitat caused by logging and other factors, indicate a need for more sophisticated and intensive management if present harvest levels are to be maintained and possibly increased.

Unfortunately, there has been little research to date on furbearers in British Columbia and much research done elsewhere has marginal applicability here. Much of the information needed to meet the challenge of resource protection and more intensive management is not available, and increased research effort is in order.

The diversity of furbearer species in British Columbia (16+ species), variety of climatic and ecological zones, and multitude of impacts on the resource and its habitat result in a great variety of management problems and potential research topics. Limited research funding needs to be directed at those areas of study which will provide answers to the most pressing management problems, i.e. those which threaten to reduce wild fur production or which place limits on increased production. This implies a need to identify and priorize those management problems and research needs.

The major objective of this study was therefore to identify and priorize furbearer management problems and research needs in British Columbia. The study was carried out under terms of a contract between the Ministry of Environment and Parks and D. Blood and Associates dated February 2, 1988. The contract supervisor was Mr. R. Archibald, Wildlife Branch. Terms of reference for the study are included as Appendix A.

Thanks are extended to Mr. Archibald for administrative support and provision of background information, and to the many trappers and Regional Wildlife and Habitat Protection Biologists/Technicians who provided information.

2.0 METHODS AND INFORMATION SOURCES

The major source of information was a questionnaire (Appendix B) sent to 43 trappers and furbearer resource managers. The mailing list is included as Appendix C. The trappers sampled are executive members and local presidents of the B.C. Trappers Association. The resource manager group included Regional Wildlife and Habitat Protection Biologists in all Ministry of Environment and Parks (Fish and Wildlife Program) Regions and Sub-regions, plus two Ministry of Forests and Lands personnel and one consultant involved in furbearer studies for the Ministry of Environment and Parks.

Questionnaire response was as follows:

	Questionnaires sent	Questionnaires returned	%
Trappers	20	17	85
Managers/Others	23	19	83
Total	43	36	84

This response rate is considered to be very good and more than adequate for the kind of analysis being carried out. At least one questionnaire was received from each Ministry Regional/Sub-regional office. In a few instances Regional Wildlife and Habitat Protection staff apparently prepared a single joint questionnaire. Trapper responses also represent virtually all parts of the province. Regional coverage is therefore considered to be good except for possible underrepresentation of the northern half of the province where fewest Ministry personnel are stationed.

The questionnaire was structured in three parts. The first dealt with furbearer management problems, the second with species priorities, and the third with species-research need combinations. This allowed an assessment of whether high priority species-research topic combinations were related to high priority management problems.

In part A of the questionnaire most respondents gave a priority rank to every management problem. The few who did not omitted the entire section on Population and Harvest Concerns and/or Animal Damage and Related Concerns. In this section it was possible to sum the scores directly, resulting in the highest priority management issues having the lowest scores. In parts B and C, as was expected, there were many blanks. To achieve realistic priorization of species and research topics in these sections rankings given by respondents to numerical scores were converted, so that highest ranked items received the highest scores, and blanks received a zero.

Time did not allow statistical tests of the results to be carried out, but this is not thought to prejudice the conclusions reached, especially for this "opinion" kind of survey.

Other sources of information consulted during the study included provincial catch and pelt value statistics, provincial management plans for furbearing species, and scientific literature relevant to the highest priority research topics.

3.0 RESULTS

3.1 Identification and Ranking of Management Problems

A first approach to identifying research priorities was to assess management problems or concerns relative to furbearers in British Columbia. A guiding principle was that research should be aimed at solving those management or related problems which most seriously threaten long-term wild fur production.

A preliminary list of furbearer management problems was drawn up based on my knowledge of the fur resource in British Columbia; problems faced by managers (Regional Wildlife/Habitat Protection Biologists) and by trappers; and suspected or known impacts of other activities (e.g. forestry) on fur species. Other sources such as provincial management plans for furbearer species or species-groups were also consulted.

A list of 20 potential management problems, broadly grouped as population and harvest concerns (total of 7), habitat concerns (9), and animal damage and related concerns (4) was presented on the questionnaire (Appendix B). Space was provided for respondents to add and rate additional concerns they may have had.

3.1.1 Relative importance of general categories

Although importance ranks varied considerably among individual management issues, these differences were less evident when they were averaged for each of the three general categories. However, both trappers and managers rated damage caused by furbearers as considerably less important than population or habitat concerns (Table 1). Both groups also tended to emphasize habitat issues slightly more than population concerns.

3.1.2 Ranking of individual management problems

Ranking derived from 36 questionnaires are presented in Table 2 and Appendix D. Considering the combined responses of trappers and managers, it is noteworthy that the four highest priority management problems are all habitat issues related to the forest industry. The first issue (lack of

Table 1. Priority ranking for general categories of furbearer management problems

GENERAL MANAGEMENT CONCERN	PRIORITY RANK[1]		
	Trappers[2]	Managers[3]	Combined
Population and harvest concerns	3.1	2.8	3.0
Habitat concerns	2.4	2.6	2.5
Damage concerns	4.0	4.0	4.0

[1] smallest number indicates highest priority
[2] based on 17 questionnaire returns
[3] based on 19 questionnaire returns

Table 2. Ranking of importance of furbearer management problems/concerns based on 36 completed questionnaires

	MANAGEMENT CONCERNS (Part A)	RANK[1]		
		T	M	C
2e	Lack of integration of furbearer and forest management	2	1	1
2b	Don't know effects of forest harvesting	4	2	2
2c	Don't know effects of silvicultural practices	3	4	3
2d	Don't know effects of forest herbicides	1	6	4
1d	Need information on factors controlling populations	6	7	5
1g	Can't determine if overharvesting is occurring	8	3	6
1a	Don't know proportion of population being harvested	8	5	7
2h	Lack information on habitat enhancement techniques	5	10	7
1b	Need information on repopulation of heavily trapped areas	7	8	8
2a	Can't identify key natural habitats	13	5	9
1c	Can't predict cyclic or other population changes	12	9	10
2i	General distrib. in relation to broad environ. factors	10	9	10
1e	Effect that trapping one species has on others	9	11	11
3b	Need information on predation by furbearers	13	12	12
3a	Disease transmission by furbearers	11	13	12
2g	Effects of industrial land uses on furbearers	10	16	13
2f	Effects of agricultural land uses on furbearers	13	13	13
1f	Can't identify areas needing re-introductions	12	15	13
3d	How to control problem species	14	11	14
3c	Forest and agriculture damage by furbearers	14	14	15

[1] The same number may appear more than once in a column if two or more concerns had the same mean scores.

T = Trappers; M = Managers/Others; C = Combined

integration of forest management and furbearer management) is really a composite expression of the following three concerns: forest harvesting; silvicultural practices other than herbicides; herbicides. Priorities 5 to 8 are primarily population- related. Effects of land users other than the forest industry and damage problems caused by furbearers were generally accorded low priority as management problems.

As might be expected, fur resource managers and users had differing opinions on the priority of some issues. Herbicides were considered the number one problem by trappers whereas government managers ranked herbicides as number 6. Managers were understandably concerned about being able to determine if overharvesting is occurring (priority 3), whereas trappers were less concerned (priority 8). Trappers probably feel reasonably confident to assess over-trapping on their own lines while managers lack information to assess harvest impacts throughout Management Units (M.U.'s) or entire regions. This difference is also evident, though less pronounced, for the closely related concern of not being able to measure the proportion of the population being harvested. Habitat enhancement problems/techniques were rated considerably higher by trappers than by managers. Trappers probably have more faith in the feasibility of habitat enhancement, while managers have more experience with the costs of limitations. The inability to identify key natural habitats was rated more highly by managers (priority 5) than by trappers (priority 13). Trappers are quite familiar with key winter habitats on their traplines whereas managers need regional, year-round, semi-quantitative habitat information when dealing with other land users.

Trappers and managers have common concerns relative to external threats to the furbearer resource and its habitat. However, these groups view some other problems from different perspectives, and these differences need to be considered when priorizing management issues as background for assessing research needs.

Other management problems suggested by respondents are listed in Table 3. Some of these re-emphasize problems already listed on the questionnaire or identify sub-components (e.g. slash-burning; FRDA program; beetle logging; clear-cutting; herbicides; communication with forest industry); others are new (biophysical mapping; aquaculture; hunting of furbearers; trapper effort data).

3.2 Species Priorities

All respondents indicated priorities from 1 through 5, and some went further. Scores for each species were determined as follows:

Table 3. Additional management problems/concerns volunteered by respondents

RESPONDENT GROUP AND CONCERN	RATING[1] (if given)
MANAGERS	
- Need trapper effort information to track harvest trends	2
- Effects of aquaculture on furbearers and vice versa[2]	
- Lack of biophysical mapping for furbearers	
- Change in population density in relation to habitat impacts	1
- Effects of slash burning on furbearers and prey	2
- Sex/age data for low point of lynx cycle	2
- Indirect benefits of habitat protection (e.g. forest management which encourages marten may reduce vole damage to seedlings)	
- FRDA program impacts on furbearer prey and habitat	2
- Beetle logging impacts on furbearer prey and habitat	3
TRAPPERS	
- Control/monitoring of furbearers legally hunted	
- Clear cut logging and burning	1
- Use of herbicides and effects on the food chain	1
- Trapper protection from mineral exploration and logging activities	1
- Slash burning	1
- Better communication with logging/forestry (larger game corridors; stay away from streams; promote selective logging)	
- Benefits of controlled burning	1
- Wetland rehabilitation (draining; dredging; damming; replanting)	2

[1] based on 1 (very high) to 6 (no importance)
[2] listed by two respondents

Rank in Questionnaire	Score
1	5
2	4
3	3
4	2
5	1
6 or greater	0
blank	0

Priority rankings for research purposes are presented for trapper, manager, and combined categories in Table 4. Total scores are also given for the combined category to indicate the relative degree of separation between species.

It is readily evident that marten and lynx are considered to be priority species for research and that marten ranks ahead of lynx. Beyond those two species some differences in opinion between trappers and managers are evident. Reasons for such differences are not readily determined from the section of the questionnaire that asked respondents to indicate the basis for their ranking because most people suggested a combination of factors and many did not use numerical rankings (the questionnaire should have been more explicit in this regard).

Trapper priorities more closely approximate the value of the catch than do those of managers. Managers gave lower ratings to beaver and mink than did trappers, probably because considerable research information is available in the literature. On the other hand, they gave considerably higher priority to wolverine and otter, probably because little information is available. It is interesting that both groups gave low priority to coyote research despite the relatively high value of that species in the provincial catch.

Priorities for the preparation of management guidelines can be expected to differ from those for research needs. For example, Regional Biologists indicated somewhat higher priority for beaver and muskrat management guidelines than for research, presumably because the biology and habitat requirements of these species are well known and because these are intensively harvested species for which management guidelines are needed.

In summary, the species ranking and numerical scores in Table 4 suggest the following priorities for research:

Table 4. Species priorities for research determined from this survey and comparative priorities from other sources[1]

THIS SURVEY[2]			VALUE IN THE CATCH[3]	MANAGEMENT GUIDELINES PRIORITIES[4]
Trappers	Managers	Combined		
Marten	Marten	Marten (149)	Marten	Marten
Lynx	Lynx	Lynx (112)	Lynx	Beaver
Beaver	Wolverine	Wolverine (55)	Beaver	Lynx
Fisher	Fisher	Fisher (55)	Coyote	Fisher
Mink	Beaver	Beaver (52)	Mink	Muskrat
Wolverine	Bobcat	Bobcat (34)	Fisher	Wolverine
Bobcat	Otter	Mink (25)	Muskrat	Bobcat
Muskrat	Wolf	Otter (22)	Wolverine	Otter
Raccoon	Muskrat	Muskrat (20)	Squirrel	Mink
Otter	Squirrel	Wolf (17)	Bobcat	Coyote
Wolf	Mink	Squirrel (8)	Fox	Raccoon
Fox	Coyote	Raccoon (7)	Otter	
Coyote	Raccoon	Coyote (6)	Raccoon	
Squirrel	Fox	Fox (5)	Wolf	
Weasel	Weasel	Weasel (3)	Weasel	
Skunk	Skunk	Skunk (0)		

[1] species in brackets have equal rank
[2] based on questionnaire returns from 17 trappers and 19 managers/others
[3] based on mean annual value of B.C. wild fur catch, 1982-83 through 1986-87
[4] data provided by Dr. D. Hatler, based on survey of Regional Biologists

Priority

very high: marten
high: lynx
moderate: wolverine, fisher, beaver, bobcat
low: mink, otter, muskrat, wolf
very low: squirrel, raccoon, coyote, fox, weasel, skunk

3.3 Species-Research Topic Priorities

This portion of the questionnaire listed 30 potential research topics, grouped into five general areas or categories. Respondents were asked to rate the importance of each research topic for each of 16 furbearers, resulting in 480 potential research/species combinations. Rankings given by the respondents were converted to numerical scores as follows:

Respondent rank	Assigned score
1	6
2	5
3	4
4	3
5	2
6	1
7+	0
blank	0

Rankings were converted to scores for the 480 research/species combinations on each of 19 questionnaires submitted by government personnel (Managers/Others) and 17 returned by trappers. Research topic-species scores were summed for each respondent group, and then combined.

3.3.1 General research categories

Relative importance of general research categories

Both respondent groups appear to feel that habitat and population research topics are more important than the others and of relatively equal priority to one another (Table 5). Techniques development research was given higher priority by managers than by trappers. Research topics related to damage caused by furbearers, as a group, were given low scores by both groups.

Table 5. Relative importance of general research categories

GENERAL RESEARCH CATEGORY	NO. OF RESEARCH TOPICS	TRAPPERS			MANAGERS/OTHERS		
		Respondents[1]	Mean Score[2]	Rank	Respondents[1]	Mean Score[2]	Rank
Techniques development	4	13	15	4	15	21	3
Population assessment	6	16	25	2	15	27	1
Habitat research	12	17	27	1	19	26	2
Damage evaluation	4	14	12	5	16	10	5
Miscellaneous topics	4	13	21	3	11	20	4

[1] Number of respondents who filled in at least one research topic/species square for the general category.
[2] Mean research topic/species score for all respondents

Techniques development

Within the category of techniques development, total scores indicated the following relative priority:

Research	Trappers	Managers	Combined
indices of abundance	2	1	1
direct inventory techniques	1	2	2
sex/age determination	3	3	3
capture; restraint; marking	4	4	4

Inventory-related research appears to have priority over age/sex techniques and capture/restraint techniques. Managers evidently felt research on indirect techniques (indices) was more important than development of direct inventory methods; trappers, however, had the opposite priorities. These differing priorities probably occur because trappers wish to know how many animals are on their traplines relative to the number they catch, whereas managers must deal with much larger and more varied areas where direct inventory is not usually feasible.

The five top-rated species with respect to techniques development were, in order, as follows:

Trappers: marten, lynx, wolverine, beaver, mink
Managers: marten, wolverine, lynx, otter, fisher
Combined: marten, lynx, wolverine, beaver, mink/fisher

Population assessment

Within the category of population research, total scores indicated the following relative priorities:

Research	Trappers	Managers	Combined
Population levels in representative habitats	1	1	1
Relationships of harvest pressure to age/sex of catch	4	2	2
Home range assessment, dispersal in untrapped populations	3	3	3
Population removal/repopulation studies	2	5	4
Population dynamics of untrapped populations	5	6	5
Development of population models	6	4	6

Although total scores for the various population-related topics did not vary greatly, research to assess population levels in representative habitats appeared to be of greatest concern. Differences between trapper and manager responses were most evident for two topics, relationships between harvest

pressure and age/sex composition of the catch (rated higher by managers than trappers), and research related to the rate of repopulation of heavily trapped areas (given more significance by trappers). More theoretical problems such as dynamics of untrapped populations and development of population models appear to be of lesser concern.

The five top-rated species relative to population-related research were, in order, as follows:

Trappers: marten, lynx, mink, wolverine, beaver
Managers: marten, wolverine, lynx, beaver, bobcat
Combined: marten, lynx, wolverine, mink, beaver

Habitat relationships

Within this general category, total scores suggested the following priorities for research:

Research	Trappers	Managers	Combined
Effects of forest herbicides	1	2	1
Effects of silvicultural practices	2	4	2
Habitat selection and requirements	9	1	3
Effects of logging on furbearer habitat	3	5	4
Use of clear cuts and seral stages	4	3	5
Habitat improvement techniques	5	7	6
Food habits and nutrition	6/7	8	7
Habitat suitability index models	10	6	8
Impacts of hydro-electric development	6/7	11	9
Impacts of mining; oil and gas development	8	12	10
Impacts of agricultural land uses	12	9	11
Wetland management for aquatic species	11	10	12

Four of the five most highly rated topics within this general research area relate to the forest industry, and the fifth, studies of habitat selection and requirements, would likely involve consideration of forestry influences in many parts of the province. Research on the impacts of other land uses is generally at the bottom of the list. Studies of wetland management are on the bottom only because few species are involved - these studies rated highly for some aquatic furbearers. Notable differences between trapper and manager priorities are apparent with respect to the need for research on habitat selection (high for managers; low for trappers), habitat suitability index models (higher for managers than for trappers) and effects of mineral, oil, and gas impacts (higher for trappers than managers).

For habitat-related research topics as a whole, the five top-rated species were as follows:

Trappers: marten, beaver, lynx, mink, wolverine/fisher
Managers: marten, beaver, lynx, wolverine, mink
Combined: marten, beaver, lynx, mink, wolverine

Damage and disease problems

Total scores in this category indicate the following priorities:

Research	Trappers	Managers	Combined
Parasite and disease transmission	1	2	1
Predation by furbearers	2	1	2
Damage to forest or agricultural crops	3	3	3
Other damage	4	4	4

Rankings were relatively similar between respondent groups except that trappers were somewhat more concerned about disease problems. In general, problems caused by furbearers were not seen as priority items for research, at least on a province-wide basis.

The five highest species ratings for research related to these topics were:

Trappers: beaver, muskrat, coyote, wolf, marten
Managers: beaver, wolf, muskrat, coyote, raccoon
Combined: beaver, muskrat, wolf, coyote, raccoon

As expected, these priorities are quite different than those for other kinds of research.

Miscellaneous topics

Within this category, total scores placed these unrelated topics in the following order of priority:

Research	Trappers	Managers	Combined
Humane trapping	1	3	1
General life-history studies	2	2	2
General distrib. in relation to environment	4	1	3
Behaviour	3	4	4

Trappers gave considerably more emphasis to humane trapping research than did managers; the opposite was true for studies of distribution in relation to broad environmental factors.

The five top-rated species with respect to research on these miscellaneous topics were:

Trappers: marten, lynx, fisher, wolverine, beaver
Managers: wolverine, bobcat, marten, otter, fisher
Combined: marten, wolverine, lynx, fisher, mink/bobcat

In this category, managers tended to give priority to species for which little research information is available while trappers tended to emphasize species important in the fur catch.

3.3.2 Relative scores for species

Total scores received by each species for all 30 potential research topics can be used as a check against priorities indicated in Part B of the questionnaire (Furbearer Species Priorities). Rankings and scores, based on Part C of the questionnaire, are given in Table 6.

Table 6 supports the earlier conclusion that marten and lynx, in that order, are the two priority species, and that the following group of five includes beaver, wolverine, mink, fisher, and bobcat, though the ordering within this group varied between the two parts of the questionnaire. The most notable difference is probably the higher ranking of beaver based on specific research questions. Again, some differences are apparent between manager and trapper responses. Trappers tended to give higher priority to research involving mink and muskrat than did managers and lower priority to bobcat, otter, and wolf.

For the combined data in Table 6, the following priorities for research appear:

Priority	
very high:	marten
high:	lynx, beaver
moderate:	wolverine, mink, fisher
low:	bobcat, muskrat, otter, coyote
very low:	wolf, squirrel, weasel, fox, raccoon, skunk

3.3.3 Species-research topic priorities

Combined response of trappers and managers

The 25 highest priority species-research topic combinations as indicated by combined responses of trappers and managers (36 questionnaires) are listed in Table 7. The list contains only six of sixteen possible furbearers, and two of those (mink and muskrat) have only one topic each in the top 25. Twelve of the top 25 priorities apply to marten, six to lynx, and five to beaver.

Among the top 25 list of research topic-species combinations, 20 were habitat-related topics, including the top nine priorities, and five involved

Table 6. Furbearer species priorities based on total scores in Part C of the questionnaire

TRAPPERS		MANAGERS/OTHERS		COMBINED	
Marten	1294	Marten	1281	Marten	2575
Lynx	1108	Beaver	935	Lynx	2034
Beaver	1065	Lynx	926	Beaver	2000
Mink	887	Wolverine	922	Wolverine	1735
Wolverine	813	Bobcat	776	Mink	1656
Fisher	782	Mink	769	Fisher	1543
Muskrat	681	Fisher	761	Bobcat	1368
Bobcat	592	Otter	735	Muskrat	1303
Coyote	539	Muskrat	622	Otter	1266
Otter	531	Coyote	563	Coyote	1102
Fox	472	Wolf	552	Wolf	963
Weasel	451	Squirrel	514	Squirrel	940
Squirrel	426	Weasel	461	Weasel	912
Wolf	411	Fox	438	Fox	910
Raccoon	373	Raccoon	377	Raccoon	750
Skunk	145	Skunk	230	Skunk	375

Table 7. The 25 highest priority species-research topic combinations as indicated by combined responses of trappers and managers

	RESEARCH TOPIC (Part C)	Species	Score
3a	Habitat selection/requirements research	marten	168
3f	Effects of other silvicultural practices	marten	159
3d	Use of logged land and seral stages	marten	159
3g	Effects of herbicides	marten	155
3g	Effects of herbicides	beaver	138
3f	Effects of other silvicultural practices	lynx	135
3c	Research on habitat improvement techniques	marten	132
3g	Effects of herbicides	lynx	131
3e	Effects of logging on habitat (vegetation and prey)	marten	127
2a	Determination of pop. densities in representative habitats	marten	125
2b	Relationships between harvest and age/sex composition	marten	124
3d	Use of logged land and seral stages	lynx	122
3h	Research on wetland management	beaver	119
3b	Food habits and nutrition research	marten	115
3a	Habitat selection/requirements research	lynx	115
3e	Habitat improvement techniques	beaver	114
2d	Territory, home range etc., in untrapped populations	marten	114
2a	Determination of pop. densities in representative habitats	lynx	111
2e	Rate of recovery of heavily trapped populations	marten	107
3e	Effects of logging on habitat	beaver	106
3g	Effects of herbicides	mink	104
3e	Effects of logging on habitat (vegetation and prey)	lynx	103
3d	Development of habitat suitability index models	marten	102
3f	Effects of other silvicultural practices	beaver	101
3h	Research on wetland management	muskrat	99

population-related research. No techniques development, damage, or miscellaneous topics were included in the top 25. This certainly stresses that habitat-related research needs are uppermost in the minds of both trappers and resource managers. Twelve of the 20 habitat-related species-research combinations are directly related to the forest industry (effects of logging; effects of forest herbicides; effects of other silvicultural practices; use of logged land and seral stages) and several of the remainder (e.g. habitat selection/requirements research) would probably involve forestry considerations. This finding stresses the over-all need for forest management-furbearer research, as seen by trappers and managers, as well as the much higher provincial importance of forestry impacts as opposed to hydro-electric, mineral/petroleum industry, or agricultural impacts.

Four of the five population-related species-research combinations in the top 25 involve marten, the other lynx. Four different population research topics are included, but determination of population densities in representative habitats appears to be of greatest concern.

Most noteworthy is the result that the four highest priority research topic-species combinations all involve marten and all involve habitat-related research primarily related to forest management. This is undoubtedly a result of the widespread occurrence of marten in British Columbia, the high economic importance of marten in the provincial trapline catch, and the widespread and drastic habitat effects caused by logging and by post-logging management practices. Four different population research topics for marten are listed in Table 7. Two appear to be of higher priority than the others: determination of population densities in representative habitats, and assessment of relationships between harvest pressure and age/sex composition of the catch.

The four highest priority research topics for lynx are the same as for marten, i.e. predominantly forestry-related habitat research. Reasons for this are undoubtedly the same as suggested for marten, while the slightly lower ranking in the case of lynx would be due to the more restricted distribution range and lower total economic worth in the catch. Only one population-related topic for lynx appeared in the top 25 - determination of population levels in representative habitats.

The five beaver research topics in Table 7 are all habitat-related. Of greatest concern seems to be the potential impact of forest herbicides on riparian vegetation used by beaver. The closely related topics of research on wetland management and on habitat improvement appear to rate higher priority than forest industry impacts, with the exception of herbicides.

The highest priority research item for mink, effects of herbicides on habitat, tends to emphasize the broad importance of this topic. The only muskrat research topic in the top 25 involves studies of wetland management. This reflects the lesser vulnerability of muskrats to forestry impacts and

the direct relationships among wetland water levels, vegetation, and muskrat production.

Comparative responses of trappers and managers

Lists of the top 25 species-research topic combinations for trappers and for managers are given in Appendices D and E, respectively. Species emphasis was quite similar:

Species	No. of entries in top 25	
	Trappers	Managers
marten	11	12
lynx	6	6
beaver	5	3
fisher	1	2
wolverine	1	1
mink	1	0
muskrat	0	1

The number of habitat, population, and damage-related topics in the top 25 were also quite similar:

	Habitat	Population	Damage
Trappers	19	5	1
Managers	20	5	0

Trappers gave generally higher priority to forestry-related research, especially herbicides (top two priorities for trappers) than did managers, and are more concerned about research on diseases of beaver, the only damage-related topic to appear in their top 25. Otherwise, the responses did not vary markedly between groups, at least for the high end of the species-research topic priority scale.

Relationship between management problems and research needs

Scores for research topic-species combinations closely reflect the previous ranking of management problems (part A of questionnaire). The four highest priority management problems were all habitat issues related to the forest industry. Population-related management problems generally received lower priority than habitat issues, and the same was true for research topics. Damage problems received lower ratings both as management problems and in terms of specific research needs. Techniques development was not presented in the questionnaire as a management problem. Although this topic did not rate highly in terms of research needs (Table 5), research on techniques (or application of findings from other areas) would be needed as background for population-related topics such as assessment of the relationship between harvest pressure and age/sex composition of the catch.

The general correspondence between management problem and research need priorities indicates that both trappers and managers see research as a means of addressing specific management issues, with highest priority research directed at the most pressing problems.

Additional research suggestions

Research topics volunteered by questionnaire respondents are listed in Table 8. Some are topics already listed on the questionnaire, but this at least serves to emphasize their importance. Most are similar to volunteered management problems listed by the same respondents on the same questionnaires (Table 3). Many topics were suggested, including some non-biological items such as compensation methods and privatization in the forest industry (of concern to trappers).

The suggested topics do not seem to require revision of the previously listed research topic-species priorities (Table 7). Any that have been suggested by more than one respondent (e.g. impacts of logging and of herbicides) were already included in part C of the questionnaire and have received due consideration.

4.0 DISCUSSION

The 25 highest priority furbearer species - research topic combinations (Table 7) contain many closely related subjects that could probably be included in a single research program. The 25 topics can generally be lumped into four groups as follows:

Highest priority

Studies of habitat selection and use by marten and lynx in logged and unlogged areas.

- 13 of the top 25 topics fall into this area.

Second priority

Population parameters of trapped and untrapped marten and lynx populations (emphasis on marten).

- 5 of the top 25 topics fall into this group.

Table 8. Additional research needs suggested by respondents

RESPONDENT GROUP AND RESEARCH NEED	PRIORITY SPECIES[1] (if indicated)
MANAGERS (7 respondents)	
- literature review to assess research needs	
- research on biophysical land capability for furbearers	
- seasonal timing in relation to pelt quality	fisher, lynx, marten, wolverine
- seasonal timing in relation to trapping vulnerability	fisher, lynx, marten
- interspecific competition for the same prey	bobcat, coyote, lynx
- interspecific competition for similar habitats	bobcat, coyote
- specific trapping techniques	8 species
- impacts of aquaculture	otter, mink
- lynx-hare relationships in spaced IDF stands	lynx
- inventory techniques for relative densities in biogeoclimatic subzones	
- inventory techniques for relative densities on traplines	
TRAPPERS (8 respondents)	
- habitat improvement (controlled burns; dredging; damming)	beaver, lynx
- introduction of foods (wild rice, grains, grasses) to enhance food chain	
- research on: impacts of clear-cut logging	
impacts of slash burning	
impacts of herbicides	
- study of methods of compensating for habitat impacts	
- effects of clear-cut versus selective logging	lynx, marten
- impacts of fall burning of slash piles	squirrel, weasel
- rate of habitat loss due to logging and 10 year projection	lynx, marten, fisher
- effects of privatization of forest industry	
- effects of herbicides/fertilizers on mice, hares, aquatic species	
- projected effects of ranching mink, fox, marten, lynx, fisher	
- effects of herbicides on beaver	beaver
- effects of selective logging	marten, wolverine, lynx
- urban raccoon populations:	
- factors responsible	raccoon
- methods of control	raccoon
- public attitudes	raccoon
- disease implications	raccoon

[1] species given a 1 or 2 ranking or obvious subject of the research topic.

Third priority

Studies of the impact of forest practices, especially herbicides, on beaver and mink and their habitat.

- 4 of the top 25 topics are of this nature.

Fourth priority

Wetland management/habitat improvement research for beaver and muskrat.

- 3 of the top 25 topics are included here.

4.1 Habitat-related Research, Marten and Lynx

Major objectives of this study program would be to assess the extent to which marten and lynx populations are affected by logging and by subsequent silvicultural practices, and to explain why the observed effects occur. This requires information on abundance, habitat use, food habits, and prey availability in unlogged habitats and in ecologically similar areas subject to various degrees of forest removal and various kinds of silvicultural treatments. This could be accomplished by long-term study of animal responses in a single study area (e.g. a typical watershed) from pre-logging through various stages of logging, silvicultural treatment, and successional development, or by simultaneous comparative study of various treated and untreated sites. Obviously, selection of study area(s) would be very important, considering the large number of biogeoclimatic zones and subzones present in British Columbia and regional variations in logging practices (e.g. cut block size) and in silvicultural practices. The study area or areas should obviously be in a region of average to above average marten and lynx abundance. In central and northern British Columbia, lynx and marten could probably be studied on a single research area, resulting in efficiency of effort. This may be impractical in the southern interior where lynx are less abundant, and would not be possible on the coast where lynx do not occur.

Study area(s) should include lands where a variety of seral stages occur or will occur, and where the most significant silvicultural practices (herbicide treatment, burning, spacing/thinning) are used. Further input on these matters will be needed from regional wildlife and forestry staff.

Field studies of this nature should be accompanied by a literature review. A good selection of literature is available on basic ecology of marten and lynx, e.g. food habits and habitat selection (Table 9). Virtually all such studies have been done outside of British Columbia, nevertheless the material is fairly applicable. Information on biomass of available food and on relationships between prey abundance and marten/lynx abundance, however, would need to be obtained for representative areas inside British Columbia.

Table 9. Some readily available North American literature on habitat relationships of marten and lynx

	MARTEN		LYNX	
	Author	Location	Author	Location
1. Food habits	Bateman 1987	Newfoundland	Brand et al. 1976	Alberta
	Buskirk 1984	Alaska	More 1976	N.W. Territories
	Cowan & McKay 1950	Canadian Rockies	Nellis & Keith 1968	Alberta
	Douglas et al. 1983	N.W. Territories	Nellis et al. 1983	Alberta
	Hargis & McCullough 1984	Yosemite	Parker et al. 1983	Nova Scotia
	Lensink et al. 1955	Alaska	Saunders 1963	Newfoundland
	Murie 1961	Wyoming	Van Zyll de Jong 1966	Alberta/NWT
	Weckwerth & Hawley 1962	Montana		
	Zielinski et al. 1983	California		
2. Habitat use	Bateman 1986	Newfoundland	Koehler et al. 1979	Montana
	Buskirk 1984b	Alaska	Parker 1981	Nova Scotia
	Douglas et al. 1983	N.W. Territories	Parker et al. 1983	" "
	Hargis & McCullough 1984	Yosemite		
	Masters 1980	New York		
	O'Neil 1980	Montana		
	Raine 1983	Manitoba		
	Spencer 1987	California		
	Spencer et al. 1983	California		
	Taylor & Abrey 1982	Ontario		
	Wynne & Sherburne 1984	Maine		
3. Forestry impacts	Campbell 1979	Colorado		
	Koehler & Hornocker 1977	Montana		
	Soutiere 1979	Maine		
	Steventon & Major 1982	Ontario		

There is some literature on impacts of logging on marten (Table 9). Impacts of logging on lynx are alluded to in some reports, but I could find no papers specifically on this topic. The widespread occurrence of marten in Canada and the United States and the known association of this species with mature conifer forests have resulted in recognition and study of marten-forestry conflicts in several areas. These studies can be generally, but not specifically, applied to British Columbia because of differing forest types and marten population densities. Information on effects of specific silvicultural practices is virtually non-existent and such information from other areas, even if it was available, would be of dubious applicability here.

There is a fair amount of literature on impacts of logging and silvicultural practices on small mammals, including snowshoe hares. A few studies have been done in British Columbia. This material is directly relevant to forestry impacts on marten and lynx. It is not reviewed here, but should be part of any literature analysis associated with this research program.

Literature on one of the silvicultural practices of greatest concern, herbicidal control of competing vegetation, was recently reviewed by Biggs and Walmsley (1987) with respect to the Pacific Northwest. They reviewed research on the effects of forest herbicides on ungulates, small mammals, and birds and concluded that this revealed "...a complete lack of research on the impact of herbicides on the habitat and food resources of... species other than those outlined previously". They reported that an objective of several small mammal studies was evidently to make inferences regarding the potential impacts of herbicide-induced habitat/prey changes on furbearing mammals, but that no assessments of such impacts were found in the literature. Biggs and Walmsley (1987) also noted that, according to research done by Morrison and Meslow (1983), the initial impact of clear-cutting has a far greater effect on wildlife than does any follow-up treatment of logged land. This would certainly seem to be true in the case of marten, a species known to have a preference for mature forest at most times of the year, and may indicate that respondents in the present study, especially trappers, have placed excessive importance on the potential impact of herbicides. This may be due to the recent high profile of this topic, stimulated by solicitation of trapper input into the Biggs and Walmsley review and by articles in the B.C. Trapper (Hatter 1986).

As well as a literature review, compilation and analysis of other existing information would provide valuable background for field studies. This should include a detailed regional analysis of marten and lynx catch statistics in relation to biogeoclimatic zones and subzones. Though complicated by regional variations in trapping effort and intermittent availability of catch records, this analysis would help to identify those forest types most productive for these species. When related to forest harvest and management plans for various regions, this information would

indicate where the most significant forestry-furbearer (marten/lynx) problems are likely to occur, and thus aid in study area selection. Analyses of this nature were begun in the 1950's (Edwards and Cowan 1957; McLeod 1950; Quick 1953).

4.2 Population Research, Marten and Lynx

Major objectives of this research program would be to determine population levels/densities and home ranges in representative habitats (including both natural and modified habitats), and to assess relationships between trapping intensity and population parameters. Research on both trapped and untrapped populations would be in order. The best approach would probably be to evaluate population density, age/sex structure, natality/mortality rates, and home range in an area that has not been trapped for several years, and then monitor changes in those factors, as well as immigration from adjacent areas, as increasing trapping pressure is applied. It would probably not be wise to carry out this research on the same study areas used for habitat selection-forestry impact studies because the combined effects of trapping and forestry activities would be difficult to sort out.

As in the case of habitat-related research it might be possible to evaluate both marten and lynx on the same study area, but there is lesser incentive to do so. Inclusion of lynx would require a considerably larger study area than needed for marten alone, and would introduce the complicating factor of cyclic population fluctuations. However, biologists have expressed an interest in obtaining age/sex information for lynx at various stages of the 10-year cycle. In any event, study area(s) should be in locations of at least average marten and lynx abundance.

A literature review on this topic would also be advisable. Some information is available on marten and lynx population densities, home ranges, and movements, almost entirely outside of British Columbia (Table 10). That for marten is mostly from habitats little influenced by logging. Population density information for lynx is sketchy, variable, and generally for habitats unlike those in British Columbia. Data on typical upper and lower population densities are badly needed for representative ecological zones in this province. Relationships between harvest intensity and age/sex composition of marten harvests have been reviewed by Strickland and Douglas (1986). Rule of thumb indices adequate to detect overharvest appear to be available for marten, so research in this area could be limited to that needed to confirm the application of such indices under British Columbia conditions. This kind of information is less complete for lynx in view of their more limited distribution, lower population densities, and widely fluctuating abundance.

Table 10. Some readily available North American literature on population parameters of marten and lynx

	MARTEN		LYNX	
	Author	Location	Author	Location
1. Population densities	Archibald & Jessup 1984	Yukon	Bailey et al. 1986	Alaska
	Francis & Stephenson 1972	Ontario	Brand & Keith 1979	Alberta
	Soutiere 1979	Maine	Brand et al. 1976	Alberta
	Thompson & Colgan 1987	Ontario	Parker et al. 1983	Nova Scotia
	Weckworth & Hawley 1962	Montana		
2. Home range & movements	Archibald & Jessup 1984	Yukon	Brand et al. 1976	Alberta
	Bateman 1986	Newfoundland	Carbyn & Patriquin 1983	Manitoba
	Hawley & Newby 1957	Montana	Koehler et al. 1979	Montana
	Raine 1982	Manitoba	Mech 1980	Minnesota
	Steventon & Major 1982	Ontario	Nellis & Wetmore 1969	Alberta
	Taylor & Abrey 1982	Ontario	Parker et al. 1983	Nova Scotia
	Thompson & Colgan 1987	Ontario	Saunders 1963b	Newfoundland
3. Population structure/ dynamics	Above references re population densities		Brand & Keith 1979	Alberta
			Brand et al. 1976	Alberta
	Hawley & Newby 1957	Montana	Mech 1980	Minnesota
	Jonkel & Weckwerth 1963	Montana	Nellis et al. 1972	Alberta
	Thompson & Colgan 1987	Ontario	Parker et al. 1983	Nova Scotia
			Quinn & Gardner 1984	Ontario
			Quinn & Thompson 1987	Ontario
			Quinn & Thompson 1985	Ontario
4. Effects of trapping	Archibald & Jessup 1984	Yukon	Bailey 1986	Alaska
	de Vos 1951	Ontario	Quinn & Thompson 1985	Ontario
	Quick 1956	B.C.	Quinn & Thompson 1987	Ontario
	Soukkala 1987	Maine		
	Strickland & Douglas 1986	Ontario		
	Yeager 1950	U.S.		

4.3 Impact of Forestry on Aquatic/Riparian Furbearers

Emphasis here would be on beaver and mink, although muskrat and otter could also be included if convenient. This concern relates not so much to the impact of timber harvesting as to that of post-harvesting treatments, especially herbicides. However, direct effects of logging could be of concern in areas where aspen and/or cottonwoods are being, or will be, cut. This trend appears to be accelerating in British Columbia.

Since forestry guidelines usually stipulate the retention of streamside strips and prohibit use of herbicides near streams or lakeshores, initial investigative effort should probably address the extent and potential seriousness of the problem. Perhaps questionnaire respondents in this study gave undue concern to this problem. However, Biggs and Walmsley (1987) gave high priority to research on herbicide impacts on furbearers and suggested that particular attention be given to "... furbearers utilizing food and cover resources of riparian and alluvial habitats, especially beaver, but also including muskrat, otter, and mink." This implies that herbicides are indeed applied in riparian habitats.

There is considerable literature on the biology of beaver and mink, including food habits and habitat selection, even though most is based on research done outside British Columbia. This however will not answer questions such as how much riparian habitat is being affected in British Columbia and to what extent this is affecting beaver and mink abundance.

4.4 Wetland Management/Improvement Research, Beaver and Muskrat

The major objective of this program would be to investigate ways of increasing beaver and muskrat production, largely through water management. Key habitats of these species, though both aquatic, are quite different and it is likely that separate species studies would be needed. Pilot or feasibility studies in habitats that are amenable to water management would seem to be the best approach.

In the case of muskrats, existing information on relationships among water levels, aquatic vegetation, and muskrat production should be reviewed and analysed for controlled marshes such as Creston Flats, Bummers Marsh, and Moberly Marsh. A major aspect of ensuing research would then be to identify and map other areas in the province amenable to similar or related development.

For beaver this research should also consider ways of promoting and maintaining desirable riparian vegetation, and even upland vegetation in topographic situations where it is available to beaver. A major aspect of this research would be to identify areas amenable to such treatment. Study of relationships among seasonal streamflow patterns and seasonal lake/pond levels and beaver habitat quality might also suggest opportunities for

enhancement. Beaver habitat research could probably be most profitably carried out in aspen- or mixed wood-dominated portions of the Interior and Alberta Plateaus.

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Appendix A.

SCHEDULE "A"

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Services

The objective of this contract is to identify and rank provincial research priorities for furbearers.

The successful contractor will be required to identify research needs for furbearers throughout British Columbia through consultation with Ministry staff, trappers and others.

The contractor will then rank these research needs provincially.

The Wildlife Branch will provide access to relevant existing information in Victoria and facilitate contact with Regional staff.

BH AL DAI March 11, &

Draft research needs are required to be submitted by ~~February 15~~, 1988, and the final report is required by March ~~15~~ 31, 1988.

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Appendix B.

QUESTIONNAIRE

RESEARCH PRIORITIES FOR B.C. FURBEARERS

A. Identification of Management Problems and Issues

Management problems must first be identified and ranked if meaningful research programs are to be designed. You are asked to rate the importance or seriousness of the following potential management problems within your geographic area of responsibility or knowledge, for the furbearer resource in general. Please use the following criteria:

1 = very high importance (very serious management problem)
2 = high "
3 = moderate "
4 = low "
5 = very low "
6 = no importance (not a management problem)

1. Population and harvest concerns — Rating

a - Don't know what proportion of the population is being or could be trapped . . . . . ___
b - Don't know how quickly or from what distance animals will repopulate a heavily trapped area . . . . . ___
c - Can't predict or monitor cyclic or other changes in abundance . . . . . ___
d - Don't know enough about factors controlling population growth and density . . . . . ___
e - Don't have information on effects that trapping one species may have on others (inter-specific competition etc.) . . . . ___
f - Can't identify areas where re-introductions may be beneficial . . . . . ___
g - Can't determine if and when overharvesting occurs . . . . . ___

2. Habitat concerns

a - Can't identify key natural habitats used for cover, feeding, or other purposes . . . . . ___
b - Don't know what effect forest harvesting is having or will have on furbearer food, cover, or other habitat needs . . . . ___
c - Don't know what effect silvicultural practices such as site treatment, tree species selection, and stand tending may have on furbearer habitat . . . . . ___
d - Don't know what effect silvicultural herbicides may have on furbearers or their food . . . . . ___
e - Lack of information needed to better integrate forest management and furbearer management . . . . . ___
f - Need information on effects of agricultural land uses on furbearers . . . . . ___
g - Need information on effects of industrial land uses on furbearers . . . . . ___
h - Lack information on habitat enhancement techniques for key habitats and species . . . . . ___
i - Don't know enough about the general distribution of furbearer species in relation to environmental factors such as forest zones, elevation, or snowfall . . . . . ___

3. Animal damage and related concerns

a - Need information on disease transmission . . . . . ___
b - " " " predation by furbearers . . . . . ___
c - " " " forest and agricultural damage caused by furbearers . . . . . ___
d - General lack of information on how to control abundance of problem species . . . . . ___

4. Other actual or potential management problems (please describe)

_____
_____
_____
_____

B. Furbearer Species Priorities

Please indicate the species you feel should receive highest priority for research in your region by numbering at least the 5 highest priority species in order (go further if you wish).

Beaver	___	Fox	___	Muskrat	___	Squirrel	___
Black bear	___	Lynx	___	Otter	___	Weasel	___
Bobcat	___	Marten	___	Raccoon	___	Wolf	___
Coyote	___	Mink	___	Skunk	___	Wolverine	___
Fisher	___						

Is your ranking based primarily on:

(1) Economic importance in the catch . . . . . ☐
(2) Lack of existing biological/ecological information . . . . . ☐
(3) Vulnerability to over-exploitation; habitat impacts . . . . . ☐
(4) A combination of above . . . . . ☐
(5) Other factors (please specify)

_____
_____
_____

C. Potential Research Needs

Please rate the priority or importance (1, 2, 3, 4, 5, 6) of the following possible research topics for each species of furbearer. If you have no opinion for a particular research need – furbearer species combination, then please leave it blank.

	Beaver	Black bear	Bobcat	Coyote	Fisher	Fox	Lynx	Marten	Mink	Muskrat	Otter	Raccoon	Skunk	Squirrel	Weasel	Wolf	Wolverine
1. Techniques development																	
a – development of techniques for direct inventory																	
b – development of indeces of abundance (e.g. track counts)																	
c – development techniques for sex and age determination																	
d – techniques for live capture, restraint, and marking																	
2. Population assessment																	
a – determine population levels/densities in representative habitats																	
b – determine relationships between harvest pressure and age/sex composition of the trapline catch																	
c – assess population dynamics of untrapped populations (long-term trends; natality; mortality; age/sex composition)																	
d – assess territoriality, home range, and dispersal in untrapped populations																	
e – population removal/repopulation studies to assess rate of recovery of heavily trapped areas and optimal spacing of possible refuges																	
f – development of population models																	
3. Habitat relationships																	
a – habitat selection/habitat requirements research																	
b – food habits and nutrition studies																	
c – habitat improvement techniques																	
d – use of clearcut land and second growth by furbearers																	
e – effects of logging on vegetation used by herbivorous furbearers and prey animals																	
f – effects of silvicultural practices (other than herbicides) on furbearers and their prey																	
g – effects of forest herbicides on furbearers and their prey																	
h – studies of wetland management for aquatic species																	
i – research on the impact of agricultural land uses (e.g. grazing)																	
j – " " " " " hydro development (reservoirs; regulated rivers; transmission line rights of way)																	
k – research on impact of mining and oil and gas activities																	
l – development of habitat suitability index models																	
4. Animal damage and related problems																	
a – research on parasites and diseases and their transmission																	
b – " " predation by furbearers on desirable wild or domestic animals																	
c – studies of damage to forest or agricultural crops																	
d – evaluation of other damage such as flooding; burrowing in dykes																	
5. Miscellaneous research																	
a – general life-history studies																	
b – behaviour																	
c – general distributton in relation to broad environmental factors																	
d – humane trapping																	

6. Additional research needs of any kind (please specify)

_____

_____

_____

_____

_____

_____

APPENDIX C. Questionnaire mailing list.

Trappers

Michael B. Green, 9007-78A St., Fort St. John, V1J 3B4
James Hatter, 3931 Tudor Avenue, Victoria, V8N 4L5
Wayne Sharpe, 6909 Langer Cres., Prince George, V2K 2N5
Paul Blackwell, Box 188, Clinton, V0K 1K0
Clarke Allen, Box 296, Clinton, V0K 1K0
Terry Stocks, 640 Val Dez, Kamloops, V2B 5J2
Robert Quaedvlieg, Box 1216, Mackenzie, V0J 2C0
Charlie Leake, Box 52, McBride, V0J 2E0
Allen Ray, Box 53, Fort Fraser, V0J 1N0
John Hansen, R.R. #1, Box 29, Cariboo Way, Fort Nelson
Carl Gitscheff, 21-1201-118th Ave., Dawson Creek, V1G 4L2
Otto Lindstrom, 4823 Haugland Ave., Terrace, V8G 1H3
Bob Gibbard, R.R. #1, 1170 Ohlhausen Rd., Penticton, V2A 6J6
Phil Bradshaw, 658 Rotary Dr., Kimberley, V1A 1E3
Jack Lay, 34462 Blatchford Way, Abbotsford, V2S 5J8
Brian Robinson, Box 186, Errington, V0R 1V0
Tony Rota, 1574 Mt. View Dr., RR#1, Site 5, Comp. 18, Revelstoke, V0E 2S0
Don Hewer, Box 2015, Golden, V0A 1H0
Steve Richburg, Tatla Lake, V0L 1V0
Don Parkins, 8503-98 Ave., Fort St. John, V1J 1P6

Government Staff/Others

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APPENDIX C. Continued

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Mr. D. King, Reg. Habitat Biologist, Min. of Environment and Parks
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Mr. A. Edie, Reg. Wildlife Biologist, Min. of Environment and Parks
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Mr. D. Steventon, Wildlife Biologist, Min. of Environment and Parks
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Mr. F. Harper, Reg. Habitat Biologist, Min. of Environment and Parks
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10142-101 Avenue, Fort St. John, V1J 2B3

Dr. D. Hatler, Box 5, Smithers, V0J 2N0

Mr. J.B. Nyberg, Min. of Forests and Lands, Research Branch
31 Bastion Square, Victoria, V8W 3E7

Dr. J. Pojar, Min. of Forests and Lands, 3726 Alfred Street
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APPENDIX D. Ranking of furbearer management problems[a]

Management problems	Trappers		Managers/Others		Combined	
	total	$\bar{X}$	total	$\bar{X}$	total	$\bar{X}$
1. Pop. concerns						
Sample size	(17)		(16)		(33)	
1a	52	3.1	33.5	2.1	85.5	2.6
1b	48	2.8	41	2.6	89	2.7
1c	59	3.5	44	2.8	103	3.1
1d	41	2.4	39	2.4	80	2.4
1e	55	3.2	60	3.8	115	3.5
1f	59	3.5	69	4.3	128	3.9
1g	53	3.1	28.5	1.8	81.5	2.5
Total	367.0	21.6	315.0	19.8	682.0	20.7
Mean	52.4	3.1	45.0	2.8	97.4	3.0
2. Habitat concerns						
Sample size	(17)		(19)		(36)	
2a	61	3.6	40	2.1	101	2.8
2b	28	1.6	31	1.6	59	1.6
2c	26	1.5	36.5	1.9	62.5	1.7
2d	20	1.2	44	2.3	64	1.8
2e	24	1.4	28	1.5	52	1.4
2f	61	3.6	78.5	4.1	139.5	3.9
2g	56	3.3	83.5	4.4	139.5	3.9
2h	38	2.2	56	2.9	94	2.6
2i	56	3.3	54	2.8	110	3.1
Total	370	21.7	451.5	23.6	821.5	22.8
Mean	41.1	2.4	50.2	2.6	91.3	2.5
3. Damage concerns						
Sample size	(17)		(17)		(34)	
3a	57	3.4	69	4.1	126	3.7
3b	61	3.6	66	3.9	127	3.7
3c	76	4.5	72	4.2	148	4.4
3d	76	4.5	64	3.8	140	4.1
Total	270.0	16.0	271.0	16.0	541.0	15.9
Mean	67.5	4.0	67.8	4.0	135.3	4.0

[a] lowest score equals highest importance

APPENDIX E. The 25 highest priority species-research topic combinations as indicated by trappers

Research Topic	Species	Score
Effects of herbicides	marten	88
Effects of herbicides	beaver	77
Effects of other silvicultural practices	marten	77
Effects of herbicides	lynx	74
Effects of other silvicultural practices	lynx	68
Determine pop. densities in representative habitat	marten	67
Use of logged land and seral stages	lynx	67
Determine pop. densities in representative habitat	lynx	66
Use of logged land and seral stages	marten	65
Effects of logging on habitat (vegetation and prey)	marten	64
Food habits and nutrition research	marten	63
Effects of herbicides	mink	62
Territory, home range, in untrapped populations	marten	62
Habitat selection and requirements	marten	62
Habitat improvement techniques	marten	61
Effects of logging on habitat (vegetation/prey)	lynx	60
Effects of other silvicultural practices	beaver	60
Habitat improvement techniques	beaver	60
Effects of logging on habitat	beaver	59
Habitat improvement techniques	lynx	58
Rate of recovery of heavily trapped populations	marten	57
Parasite and disease transmission	beaver	56
Effects of herbicides	fisher	55
Effects of herbicides	wolverine	54
Relationship between harvest and age/sex comp.	marten	54

APPENDIX F. The 25 highest priority species-research topic combinations as *indicated by managers/others*

Research Topic	Species	Score
Habitat selection/requirements research	marten	106
Use of logged land and seral stages	marten	94
Effects of other silvicultural practices	marten	82
Develop habitat suitability index models	marten	73
Research on habitat improvement techniques	marten	71
Relationship between harvest and age/sex composition	marten	70
Habitat selection/requirements research	lynx	68
Effects of herbicides	marten	67
Effects of other silvicultural practices	lynx	67
Habitat selection/requirements research	wolverine	67
Research on wetland management	beaver	66
Effects of logging on habitat (vegetation and prey)	marten	63
Habitat selection/requirements research	fisher	62
Effects of herbicides	beaver	61
Research on wetland management	muskrat	61
Assess pop. density in representative habitat	marten	58
Effects of herbicides	lynx	57
Use of logged land and seral stages	lynx	55
Research on habitat improvement techniques	beaver	54
Territory, home range, in untrapped populations	marten	52
Food habits and nutrition research	marten	52
Use of logged land and seral stages	fisher	52
Relationship between harvest and age/sex composition	lynx	52
Research on indices of abundance	marten	51
Develop habitat suitability index models	lynx	51